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ABSTRACT

This paper is a narrative account of a critical classroom episode in the life of a beginning secondary science teacher. Emphasis is placed on a beginning science teacher's prior knowledge of effective science instruction and is used to guide on-going classroom practices to facilitate student learning. The story is created from classroom observations of a secondary science teacher intern, formal and informal interviews with the teacher intern, and a critical autobiography describing his views on science, knowledge, teaching, and learning. The story revolves around an issue the teacher is confronted with related to poor laboratory report grades. The issue is resolved by the teacher's decision to conduct a science process lesson in which students re-interpret their laboratory findings and present their results before the entire class. (Author/DDR)

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A Narrative of a First Year Science Teacher

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Abstract

This paper is a narrative account of a critical classroom episode in the life of a beginning secondary science teacher. The theme of the story is that a beginning science teacher's prior knowledge of effective science instruction is used to guide on-going classroom practices to facilitate student learning. The story is created from classroom observations of a secondary science teacher intern, formal and informal interviews with the teacher intern, and a critical autobiography describing his views on science, knowledge, teaching, and learning. He also describes his exceptional science teachers in the autobiography. The teacher story begins in a high school Honors Biology classroom. Students express dismay at their poor scores on a recently graded laboratory report. The plot turns to the teacher's reflection and deliberation on potential strategies to resolve the laboratory dilemma. To resolve the issue, he decides on a science process lesson in which students re-interpret their laboratory findings and present their results before the entire class. His decision is based on his prior knowledge and beliefs of effective classroom instruction.

Purpose

The purpose of this research is to describe a beginning high school science teacher's classroom practices in the context of his prior knowledge and beliefs. Tobin (1993) noted that science teachers situate their prior knowledge and beliefs as referents to guide their daily classroom practices. In this paper, a teacher's on-going classroom practices are linked to his prior science classroom experiences. These experiences frame his knowledge and beliefs about effective science instruction.

The beginning teacher's prior knowledge, beliefs, and classroom practices are reported in the narrative form of a story; however, "narrative is more than a mode of reporting, it is a way of knowing" (conversation with Ken Tobin, 8/5/94). Accordingly, this story is a way of understanding a beginning science teacher's classroom actions in the context of what his actions mean to him.

Synopsis of the story

The story portrays a crucial episode in the life of a beginning high school biology teacher. The teacher deliberates on a recent laboratory exercise in which the majority of his students failed to identify and illustrate a human cheek cell. Student failure in properly illustrating a cheek cell has created a dilemma for the teacher. He knows that his students are very concerned about their learning and grades, thus he believes that something must be done beyond simply marking off the incorrect diagrams. Additionally, the teacher feels partly responsible for the poor showing on the student laboratories.

To resolve this dilemma, the teacher reflects on his prior experiences as a student in high school and college science courses. He recalls his

frustration with one of his college instructors who failed to explain the expected results for a chemistry laboratory and how this experience resulted in a lost learning opportunity. Rather than learn the subject matter and laboratory method germane to the experiment, he learned that when the instructor failed to clarify the expected laboratory results, his learning was stifled and a subsequent deep seated frustration developed. This frustration, heightened by the lowering of his laboratory grade, was directed towards the instructor and his teaching style.

The beginning teacher decides to offer students an opportunity to critically examine their laboratory techniques and present their findings to the entire class. His decision is linked to his views of one of his own high school role model teachers. After informing the students of his decision, the teacher contrasts his model high school science teacher with the chemistry laboratory instructor. The beginning teacher describes his model teacher as a referent from which he frames his solution to the laboratory dilemma.

Theoretical Frame

Richardson notes that "Narrative is both a mode of reasoning and a mode of representation" (1990, p. 21). From this theoretical perspective, story is an interpretative sense-making method as well as a form of data reporting. Richardson adds, "The narrative code demonstrates narrative reasoning, the type of reasoning that understands the whole by the integration of its parts" (ibid.).

The story narrative represents the shell of the teacher's actions. His intended meanings are situated within his prior knowledge and beliefs which structure classroom practices. The beginning teacher's classroom practices

are interpreted through his reflection on prior experiences as a high school and post high school science student.

Thick description is used to detail the teacher's perceived experiences and structure his sense-making connections of prior knowledge and on-going classroom experiences (Geertz, 1973). Eisner defines thick description as "an effort aimed at interpretation, at getting below the surface to the enigmatic aspect of the human condition: the construction of meaning" (1991, p. 15). Therefore, an examination into teacher classroom practices is an examination into the meanings the teacher constructs of how is classroom lessons and assessment influence student learning. Finally, thick description is vital in unraveling the context of the teacher's classroom practices.

Design

This story was created from experiences with a student teacher who has since entered the teaching profession. The student teacher is projected in a fictional Honors Biology classroom where he is in his first year of teaching. The reason for advancing the student teacher forward in is to separate him from direct contact with his cooperating teacher and me--his university supervisor. This gives the teacher more control in constructing and modifying his classroom lessons and assessments. The beginning teacher is situated apart from his university education courses, university faculty, and other student teachers. The result of this separation illustrates the isolated nature of the classroom environment which many first year teachers encounter (Lieberman & Miller, 1992).

The student teacher was observed teaching high school biology during his student teaching internship in a high school located in a small city in the southeastern US. During informal lunch conversations and formal tape

recorded interview sessions, the teacher related his beliefs on the teaching and learning of science through a critical reflection on his teaching and learning experiences.

Efforts to ensure dependable, authentic, and credible data have been obtained through a variety of data sources including observation notes, transcribed interviews, informal conversations, autobiographical writing, e-mail, and phone conversations over a two year period. Sufficient time was spent with the student teacher, including three hours of classroom observation and two hours of audio recorded interviews (Guba & Lincoln, 1989). The teacher wrote an 18 page critical autobiography of his significant science classroom learning experiences. In the autobiography, he described his exceptional science teachers.

The teacher conducted a member check on the story. He reviewed, critiqued, and summarized the story. This check served to "correct errors of fact or errors of interpretation" (Guba & Lincoln, 1989, p. 239). Upon reviewing the story the teacher commented that it was authentic. The teacher suggested, "The character in the story believes in the same things I believe in for teaching and student-teacher relationships" (e-mail from teacher, 3/30/95).

Finally, a design in narrative research is incomplete without acknowledging the significance of the researcher's experiences in science classrooms. Having taught science at the secondary level, I assert that prior knowledge and beliefs about teaching and learning relate to what teachers do in classrooms. Interpretations of the student teacher's classroom practices have been integrated into my prior knowledge of high school science teaching and reported through the beginning teacher story.

Credibility/Transferability

Credibility in this qualitative inquiry is parallel to internal validity in behaviorist studies. Rather than focus on an external reality independent of the mind, this research centers on the constructed realities of the student teacher and the researcher. To verify the credibility of this study, the following steps have been taken: (1), prolonged engagement with the teacher participant over a two year period; (2), conducted member checks with the teacher; and (3), monitored my own subjectivity throughout the research event by asking the teacher and other science educators to comment on my interpretations presented in the story (Guba & Lincoln, 1989).

Rather than claim generalizability, this paper aims toward transferability (Lincoln & Guba, 1989). Transferability refers to the usefulness of information in the mind of the reader in the context of her or his own particular learning environment. In this inquiry, evidence is not gathered to prove a point, instead the point of contention is transferred to the reader.

The Story

Tonya spoke out: "Mr. Wells, I can't believe this! Why did I lose points on my drawing? Could you *please* go over yesterday's lab before the end of the period?" Many students saw Tonya toss her lab report down on her desk. When a nearby student leaned over from his chair and asked her what was wrong, Tonya quipped "my lab grade is *what's wrong!*" Tonya sat back in her chair and crossed her arms defiantly.

As Mr. Well's continued returning the graded laboratory reports, Leroy exclaimed "What's wrong with *my* lab? Why is the cell drawing marked off? Man, this isn't fair."

Other students were heard grumbling across the room. "He graded the labs wrong" said one student. "He messed up" whispered another. "How many points is this lab worth anyway?" came from the rear of the room.

Mr. Wells expected a few questions, but he had not anticipated an avalanche of protest. As a hard working, conscientious first year teacher he was concerned about student comments and this was their strongest criticism to date. Mr. Wells knew the junior Honors Biology students were concerned about their grades. These students would attend college in a year and half and many would choose a science or science related major. He knew that most of these students valued learning and earning high marks.

Tonya and Leroy had voiced strong objections and they rarely complained in class. Mr. Wells wanted to quickly address their questions and concerns to clear up confusion about the laboratory grades. Before saying anything, he finished handing back the laboratory papers to the students and approached the demonstration table at the front of the room. With thoughts racing through his mind, Mr. Wells replayed the events from the night before. He had been sitting at home with the laboratory papers spread out before him on the kitchen table when he asked, "Sharon could you come over here and look at these labs?"

"Just a second Honey, I'll be right there" Sharon replied while glancing from the bassinet to her husband. Grading papers, preparing lessons, and talking about school matters had become an after dinner custom in the Wells household. Sharon was proud of Jim's diligent, caring work ethic. She peeked one more time into the bassinet and saw Deborah asleep. Then she walked over and sat down next to Jim and asked "What is it?"

Jim asked, "Would you look at these labs from Honors Biology?" and handed her a lab paper.

Sharon skimmed through the handout and noticed a box labeled Human Cheek Cell 100X. "Is this suppose to be a cheek cell?" she asked pointing to three penciled dots. Jim shook his head up and down in the affirmative. Sharon commented that the diagrams leave much to the imagination.

Jim blew a puff of air and said tiredly: "It seems half the students didn't draw anything close to a cheek cells."

Sharon looked at Jim and asked if the students set the correct magnification on their microscopes? Jim replied that he thought they had. but he didn't have time to check all the microscopes during the laboratory.

Sharon commented, "Well, how are you going to grade these diagrams?" Jim walked over to the kitchen sink and picked up a clean drinking glass from the dish drying rack. He turned on the cold water and thought to himself that if he counted the drawings on the cheek cell labs, half the class would score poorly. Could it be his fault since he didn't have time to check student progress during the laboratory? He figured it was important to mark the incorrect diagrams if he couldn't understand the cheek cell illustrations. If he didn't mark the diagrams wrong, then those students with incorrect diagrams would earn the same amount of credit as others who drew recognizable cheek cells. Jim filled his glass with water and turned to Sharon saying in an exasperated tone, "I am not sure what to do with these labs. Any suggestions?"

Looking up from a lab report, Sharon exclaimed, "Wait a minute. Do you remember the chemistry course we took a few years ago at the University? Remember the qualitative analysis laboratory when our unknown did not turn the color it was suppose to and we got the wrong result?"

"Sure, I remember" Jim lamented. The graduate assistant had marked Jim and Sharon's laboratory answers wrong even though they explicitly followed the procedures. They believed they identified the correct unknown.

Sharon interjected, "I remember how upset you were when we got a 'D' on that lab." What made Jim upset was that the instructor never took time to explain what he and Sharon had done wrong. Sharon continued, "The lab instructor was just too busy to explain the correct answer. I think there were about 30 students in our lab and he said he taught three sections of the laboratory that semester. He didn't hold regular office hours either."

Jim carried his glass of water to the table and sat back down in his chair while stating, "If he'd only explained what we had done wrong I would have learned more chemistry. We did each step by the book, sterilized glassware and followed procedures."

Sharon suggested that Jim consider two or three possible alternatives for grading the lab reports and weigh the advantages and disadvantages of each. Jim stated, "Well, I suppose I could throw the lab out and not count it for a grade. This action may satisfy those students who did not draw cheek cells correctly. However, I don't want to start a precedent of not counting laboratory reports for credit. Everything we have done in Honors Biology has been important for their learning and grades."

Sharon countered, "Couldn't you just throw out the cheek cell diagram and evaluate the other parts of the lab?"

Jim sat silent for a moment then replied, "But what about those students who drew the cheek cells correctly? Don't those students deserve points for their accurate representations?" Jim raised his glass of water to his lips while starring at the plastic Santa Claus magnet on the refrigerator door. He fell silent. Sharon knew Jim was thinking. After reflecting further on the

labs, Jim decided to mark off the incorrect diagrams and reconsider the cheek cell laboratory before class tomorrow.

Early the next morning while seated again at the kitchen table, Jim poured dry raisin bran cereal into a green plastic bowl. Sharon walked out of the bedroom holding the baby in her arms. She wondered whether Jim made a final decision about the biology labs. She carried Deborah up to the table and asked in her playful, animated voice, "Deborah wants to know if you have given any more thought to those biology labs? What are you going to do?" ...

"What are you *going to do*? *Mr. Wells*, what are you going to do?" Tonya's voice interrupted his reverie.

Mr. Wells became suddenly aware of the classroom again. After the room became quiet, he announced, "I have given a lot of thought to your labs and want to find out where some of you went wrong."

Tonya popped out of her seat and announced, "Wait, Mr. Wells, give me a piece of chalk and I'll show you." She hurried to the teacher bench, picked up a piece of white chalk and before Mr. Wells could say anything, she stepped up to the chalkboard. Tonya exclaimed, "I'll draw the cheek cell exactly as I saw it." Tonya's diagram looked like the one from her lab paper. "Isn't that what cheek cells are suppose to look like?" she asked turning to Mr. Wells.

Before Mr. Wells could respond, Leroy spoke out, "Tonya that looks like a bunch of balloons." A few students giggled.

Tonya turned towards Leroy with her left hand resting on her hip and said, "Very funny Leroy, if you are such an expert lets see what *your* drawing looks like?" Everyone in class turned and looked at Leroy.

Leroy nervously peered about the room and said, "My cheek cell drawing looks like dots, beautiful tiny dots, isn't that what they're suppose to look like Mr. Wells?" .

"Not exactly" Mr. Wells answered. A shot of laughter ripped through the room.

"Thanks for the drawing Tonya" Mr. Wells said while gesturing toward her chair. Then he turned to the whole class. "Under ideal circumstances with the magnification from yesterday, cheek cells shouldn't look like dots or like this" pointing to the chalkboard. Mr. Wells picked up a chalk and drew a detailed diagram of a cheek cell and labeled the nucleus and other cell organelles. Some students recognized that Mr. Well's diagram looked similar to their own. Two boys sitting near the back of the classroom raised their hands triumphantly over their heads and gave each other high-five's.

"So, are you going to count this lab or not?" Tonya asked from her desk.

Mr. Wells replied, "Tomorrow we will redo the lab and everyone will have an opportunity to justify their drawings with a set of explanations of what they saw. I want you to describe in detail your exact procedures from yesterday, step-by-step. Also, check the microscope, maybe it wasn't working properly, or the error could be in the way you prepared the slide. Remember, it is important to add only one drop of water to the slide and carefully place a cover slip over the cells to eliminate trapped air bubbles. I want you to report on your diagram from yesterday to the best of your ability. See if you can duplicate your results. You will receive full credit if you thoroughly report on what you did. After redoing the lab each of you will give a three to five minute oral presentation to the class on Monday.

Your presentation will include an overhead of your cell diagram and a description of what you learned about: cheek cells, laboratory procedures, and anything else related to this lab."

Leroy raised his left fist, twirled it in the air above his head and replied, "That's cool, Mr. Wells. Tomorrow, I'll get it."

Tonya followed, "Thank you for giving us another chance."

Mr. Wells began walking to the doorway and said, "And the next time we do a lab, I will make a better effort to come around to your stations so you can show me exactly what you are viewing under the microscope." Just as Mr. Wells reached the door, the dismissal bell sounded and the students picked up their book bags and proceeded out of the room.

Leroy, the last student to leave, said "See you tomorrow Mr. Wells" in his friendly, good nature manner.

After the students had cleared the hallway, Jim sat down at his desk in the corner of the room and looked through the windows as students walked to their cars in the student parking lot. As car doors slammed and engines started, he thought about today's Honors Biology class. Later that evening Sharon would ask what he did regarding the cheek cell lab. He was satisfied, at least for now, that he had made a good decision.

Gazing across the empty room reminded Jim that it hadn't been long since he sat on the other side of the teacher's desk. Jim could remember Ms. Franklin, his grade nine science teacher, and how she encouraged him to do special science projects. He remembered designing his own experiments to determine how various amounts of sunlight related to corn seedling growth and how water runoff from a new housing development effected a stream next to his high school. Additionally, Ms. Franklin encouraged student

discussions and debates related to studies on rainforests and endangered species.

Ms. Franklin was enthusiastic, knowledgeable, and friendly, probably the best teacher Jim ever had. She helped him understand that science was an investigation into the workings of the natural world. Jim came away from her class with an understanding that memorizing 'textbook' definitions wasn't all there was to science. The exciting aspect of science was inventing ways to solve problems and learning about the natural world.

Concerning teaching strategies, Ms. Franklin explained the purpose behind each class activity. She always made efforts to inform students when they were correct and where improvements were needed. She developed a rapport with Jim that emphasized a professional, caring student-teacher relationship. Ms. Franklin's caring was evident in her willingness to point out student mistakes to help them learn. Her teaching style was in contrast to the graduate teaching assistant from his college chemistry laboratory. The chemistry teacher subtracted points without explaining where students made mistakes.

After thinking more on his decision regarding the cheek cell laboratory, Jim concluded that he patterned his decision after Ms. Franklin's style of teaching. He believed that students needed to learn from their errors and have opportunities to explain their laboratory procedures and findings to other class members. According to Jim, learning from one's mistakes and sharing knowledge were essential components of science.

Tired, yet pleased that the day went well, Jim got up and slid the wooden chair under his desk. He erased the chalkboard and turned off the classroom lights before locking the door and heading home.

Analysis

Jim strove to work hard in Ms. Franklin's class to learn biology, earn a high grade, and please her. Similarly, he wanted his own students to respect him as a proficient, caring teacher. He believed students would likely be more cooperative and willing to work if they thought of him the way he thought of Ms. Franklin.

Jim believed students, and everyone else for that matter, integrated their prior knowledge into ongoing experiences to modify their existing knowledge structure. He believed that students organized their constructed knowledge and retained it in the same way files are stored in a computer or file cabinet. Once in storage, sense-making experiences occurred as files were examined to understand on-going experiences. In sum, Jim believed students constructed knowledge through their perception of experience premised on their prior knowledge.

From the preceding story, students had an experience of examining and re-presenting a human cheek cell. This event would help shape their future experience when they repeated the laboratory. Students would share their knowledge of the laboratory procedures and the cheek cells through words and diagrams during the classroom presentations.

The cheek cell diagram dilemma offered a prime opportunity for Jim and his students to utilize the processes of science. Students were given opportunities to replicate their investigation. Additionally, students would collaborate their findings to determine the significant features of cheek cells. Replication of results and collaboration among members of the scientific community are two significant processes in the construction of scientifically viable knowledge.

Even though Jim and Sharon could not understand many of the student cheek cell drawings, Jim was able to facilitate learning by having students analyze what they did in the laboratory. Understanding meant coming to know what a cheek cell looks like through a socially negotiated dialog involving the teacher and students. The dialog would occur as students presented their laboratory techniques and compared their findings.

Jim was portrayed as a conscientious beginning science teacher who facilitated learning by listening to students and critically examining his classroom practices through a reflection of his prior knowledge and beliefs about the teaching and learning of science. Jim was an empathetic listener. Eisner said it well: "Empathy is the ability to don the shoes of another human being" (1991, p. 37).

Jim did not wish to deny his students the opportunity of learning from their mistakes as happened to him in a college chemistry laboratory. Rather, he utilized his past experience in Mr. Franklin's class to guide his on-going classroom practice. Jim emulated Ms. Franklin's teaching style as he created an innovative classroom activity emphasizing individual discovery and group negotiation.

As a first year science teacher, Jim developed a sense of how to guide student learning particular to student needs, interests, and motivations. Students in this story believed understanding biology and exemplary grades would facilitate their future success in the biology class, college, and beyond.

Conclusion

The theme of this paper is that the performance of beginning science teachers may be enhanced through their reflection on experience as a high

school and college student of science. Beginning high school science teachers have unique prior classroom experiences which can be useful in their daily classroom instruction. These experiences, gained primarily from their perceptions as a student, can be used to inform their on-going classroom practices. By bringing prior knowledge to the forefront through reflection, beginning teachers are able to analyze their beliefs and classroom practices. The cheek cell laboratory was a crucial episode to the beginning teacher since this experience spurred a reflection on experience and enabled him to gain a fresh perspective into how to facilitate student learning.

Linked to beginning teacher descriptions of model educators is their understanding of science, knowledge, teaching, and learning in the context of the needs, interests, and motivations of their students. Beginning teachers ought to be encouraged to reflect on and make explicit the concepts that are connected to the teaching and learning of science.

Ultimately, the cheek cell dilemma was a crucial episode early in Jim's science teaching career. He was able to accurately interpret student interests and motivations while creating a science activity which facilitated science learning. In time, a few of his former students may regard him as one of their own exceptional teachers.

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